THE KDF9 INTERNAL CODE AND CHARACTER SETS

The following table displays the characters sets of the KDF9 line printer, punched tape/Flexowriter and punched card devices, tabulated according to their internal 6-bit character codes. The Flexowriter, like a typewriter, has both a normal case set and a shift case set

Line printer	SP	NLC	LS	PC	NLC	NLC	%	'
Normal Case	SP	NLC	LS	PC	HT	NLC	CS	CN
Shift Case	SP	NLC	LS	PC	HT	NLC	CS	CN
Card rows	*none*	Y68	Y28	028	058	Y58	048	Y78
Octal code	00	01	02	03	04	05	06	07

Line printer	:	=	(	)	£	*	,	/
Normal Case	NLC	NLC	NLC	NLC	NLC	NLC	NLC	/
Shift Case	NLC	NLC	NLC	NLC	NLC	NLC	NLC	:
Card rows	48	38	X58	X28	X38	X48	038	01
Octal code	10	11	12	13	14	15	16	17

Line printer	0	1	2	3	4	5	6	7
Normal Case	0	1	2	3	4	5	6	7
Shift Case	↑	[	]	<	>	=	×	÷
Card rows	0	1	2	3	4	5	6	7
Octal code	20	21	22	23	24	25	26	27

Line printer	8	9	NLC	10	;	+	-	.
Normal Case	8	9	_	10	;	+	-	.
Shift Case	(	)	_	£	;	≠	*	,
Card rows	8	9	068	X68	Y48	Y	X	Y38
Octal code	30	31	32	33	34	35	36	37

Line printer	NLC	A	B	C	D	E	F	G
Normal Case	NLC	A	B	C	D	E	F	G
Shift Case	NLC	a	b	c	d	e	f	g
Card rows	078	Y1	Y2	Y3	Y4	Y5	Y6	Y7
Octal code	40	41	42	43	44	45	46	47

Line printer	H	I	J	K	L	M	N	O
Normal Case	H	I	J	K	L	M	N	O
Shift Case	h	i	j	k	l	m	n	o
Card rows	Y8	Y9	X1	X2	X3	X4	X5	X6
Octal code	50	51	52	53	54	55	56	57

Line printer	P	Q	R	S	T	U	V	W
Normal Case	P	Q	R	S	T	U	V	W
Shift Case	p	q	r	s	t	u	v	w
Card rows	X7	X8	X9	02	03	04	05	06
Octal code	60	61	62	63	64	65	66	67

Line printer	X	Y	Z	NLC	NLC	NLC	NLC	Ø
Normal Case	X	Y	Z	NLC	NLC	→	NLC	Ø
Shift Case	x	y	z	NLC	NLC	→	NLC	Ø
Card rows	07	08	09	58	68	78	X78	28
Octal code	70	71	72	73	74	75	76	77

KEY:

SP is (blank) Space; LS (Line Shift) is Newline (i.e. Carriage Return Line Feed); PC is Page Change (i.e. Form Feed); HT is Horizontal Tab; CS is Case Shift; CN is Case Normal. NLC indicates a **n**on-**l**egible **c**haracter (always suppressed by the line printer). Code 75 is the 'End Message' character, which terminates certain I/O transfers. Codes 74 and 76 are used to control offline printing of spooled output on magnetic tape. Code 77 is a 'filler' that is completely ignored by legible I/O devices and so can be used to pad transfers to a whole number of words.

The underline '_' does not advance the Flexowriter carriage and so is over-printed by the following character; it is used to represent Algol 60 'publication language' basic symbols, e.g., '**begin**', as '<u>begin</u>'.

The '$_{10}$' is the single-character exponent delimiter used in Algol 60's real number syntax.

Punched cards have 80 columns of 12 rows. Rows 0-9 represent the decimal digits with a single punched hole. The other two rows are called X, above 0, and Y, at the top (on some non-KDF9 systems these are known as 11, just above 0, and 12 or 10 at the top). Most non-numeric characters are represented by combinations of two or three holes, one from rows Y, X, or 0, and the others in rows 1 through 8.

KDF9 PAPER TAPE CODE (WITH PARITY CHANNELS)

This table shows the 8-bit external encoding of the character set on paper tape, as used by the KDF9 Flexowriter. The least significant 4 bits of the internal code are punched in channels 1 through 4, bits 5 and 6 being punched in channels 6 and 7. Channel 5 is used only to distinguish a space, SP, character from an empty paper tape frame (blank leader, with code 000). Channel 8 of the tape frame is an even-parity bit. A frame with all holes punched (code 177) is also treated as empty.

Normal Case	SP	NLC	LS	PC	HT	NLC	CS	CN
Shift Case	SP	NLC	LS	PC	HT	NLC	CS	CN
Paper tape	220	021	022	003	024	005	006	027

Normal Case	NLC	NLC	NLC	NLC	NLC	NLC	NLC	/
Shift Case	NLC	NLC	NLC	NLC	NLC	NLC	NLC	:
Paper tape	030	011	012	033	014	035	036	017

Normal Case	0	1	2	3	4	5	6	7
Shift Case	↑	[	]	<	>	=	×	÷
Paper tape	060	041	042	063	044	065	066	047

Normal Case	8	9	–	$_{10}$	;	+	-	.
Shift Case	(	)	_	£	;	≠	*	,
Paper tape	050	071	072	053	074	055	056	077

Normal Case	NLC	A	B	C	D	E	F	G
Shift Case	NLC	a	b	c	d	e	f	g
Paper tape	120	101	102	123	104	125	126	107

Normal Case	H	I	J	K	L	M	N	O
Shift Case	h	i	j	k	l	m	n	o
Paper tape	110	131	132	113	134	115	116	137

Normal Case	P	Q	R	S	T	U	V	W
Shift Case	p	q	r	s	t	u	v	w
Paper tape	140	161	162	143	164	145	146	167

Normal Case	X	Y	Z	NLC	NLC	→	NLC	filler
Shift Case	x	y	z	NLC	NLC	→	NLC	filler
Paper tape	170	151	152	173	154	175	176	157

KDF9 5-HOLE PAPER TAPE CODES

This table shows the characters output for a 5-hole tape punch. The codes correspond to the Ferranti 5-hole paper tape system, as used on the Pegasus, Sirius and Orion computers.

KDF9 code	40	21/41	22/42	36/43	24/44	30/45	31/46	27/47
Letters Case	*fc*	A	B	C	D	E	F	G
Figures Case	*fc*	1	2	*	4	(	)	7
Ferranti code	00	01	02	03	04	05	06	07

KDF9 code	30/50	35/51	25/52	36/53	54	55	00/56	37/57
Letters Case	H	I	J	K	L	M	N	O
Figures Case	8	≠	=	-	*v*	*lf*	*sp*	.
Ferranti code	10	11	12	13	14	15	16	17

KDF9 code	20/60	23/61	62	23/63	75/64	25/65	26/66	17/67
Letters Case	P	Q	R	S	T	U	V	W
Figures Case	0	>	≥	3	→	5	6	/
Ferranti code	20	21	22	23	24	25	26	27

KDF9 code	26/70	31/71	35/72	33	37		76	77
Letters Case	X	Y	Z	*lc*	.	?	£	*del*
Figures Case	×	9	+	*lc*	.	*n*	*cr*	*del*
Ferranti code	30	31	32	33	34	35	36	37

KEY:

- Ferranti code 00 is the Figures Case shift character, denoted *fc* above.
- Ferranti code 33 is the Letters Case shift character, denoted *lc* above.
- Ferranti code 14 is the cursive *v* character in Figures Case, but L in Letters Case.
- Ferranti code 15 is the Line Feed character in Figures Case, denoted *lf* above, but M in Letters Case.
- Ferranti code 16 is the blank space character in Figures Case, denoted *sp* above, but N in Letters Case.
- Ferranti code 35 is the cursive *n* character in Figures Case, but ? in Letters Case.
- Ferranti code 36 is the Carriage Return character in Figures Case, denoted *cr* above, but £ in Letters Case.
- Ferranti code 37 is used to *del*ete paper tape characters by punching holes in all positions of the tape frame.
- Where two KDF9 codes are shown, the first produces the Figures Case character and the second the Letters Case character. The necessary case shifting characters are inserted by Director. Director also converts KDF9's Line Shift character (like an ASCII NL, with CR LF effect) into a *fc cr lf* sequence.

KDF9 GRAPH PLOTTER CODES

Action	Decimal	Octal	Binary
None	0	#0	000000
Step paper back	1	#1	00000**1**
Step paper forward	2	#2	00001**0**
Step pen right	4	#4	00010**0**
Step pen right, paper back	5	#5	00010**1**
Step pen right, paper forward	6	#6	00011**0**
Step pen left	8	#10	00**1**000
Step pen left, paper back	9	#11	00**1**00**1**
Step pen left, paper forward	10	#12	00**1**01**0**
Lower pen	16	#20	0**1**0000
Raise pen	32	#40	**1**00000

KEY:

- All other 6-bit character codes represent invalid plotter commands.
- It is confidently asserted that the plotter command list in Appendix 6, §5, p.302 of the Manual is wrong. as there is an obvious error whereby 11 plotting codes are claimed but only 9 are given, the last of them being inconsistent with the others. The present list provides the two missing codes and corrects the incorrect code, given by the Manual as 001001, for a step right and backwards. The codes listed here have been confirmed by the evidence of other computers of the era that used the same plotter; the bit positions and their interpretations correspond directly to the control bits in the Calcomp plotter's hardware interface.

See: https://ub.fnwi.uva.nl/computermuseum//calcomp565.html